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RESEARCH PAPER

Comparison of some botanicals with chemical against aphid (*Lipaphis erysimi Kalt.*) on mustard (*Brassica juncea* L.)

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The present investigation was conducted during *Rabi* season of 2013 –ecofriendly management of mustard aphid (*Lipaphis erysimi* kalt.) on mustard (*Brassica juncea* L.) at Research field, Naini, Allahabad using Randomized Block Design (RBD) method in three replications. The seven treatments namely cypermethrin 25EC, marigold leaf 5 per cent, cow urine 17 per cent, neem oil 0.1 per cent, neem leaf extract 5 per cent,*Calotropis procera* leaf 5 per cent , kinnow leaf 5 per cent as treatments were used to check their efficacy against mustard aphid (*Lipaphis erysimi* Kalt.) on mustard. The observations on infestation of *Lipaphis erysimi* (Kalt.) 24 hours before (pre – treatment) and 3rd, 7th and 14th day after treatment (post – treatment) at two spraying were recorded for computing the mean aphid infestation. The data were subjected to statistical analysis (ANOVA) after appropriate transformation for interpretation. Insecticides treatments were applied as respective two sprays which revealed that the application of insecticides, significantly decreased the aphid infestation in 3 and 7 days and significantly 14 days resulted better performance. The minimum aphid infestation was observed with the cypermethrin 25EC (69.87), neem oil 1 per cent (68.01), marigold leaf 5 per cent (67.96) neem leaf extract 5 per cent (46.79), *Calotropris procera* leaf 5 per cent (46.52),cow urine (63.46) and kinnow leaf 5 per cent (60.59), minimum aphid infestation was observed it was also superiorly significant and more effective as compared to all other treatments. The data regarding seasonal incidence was also recorded and the highest population of mustard aphid (*Lipaphis* erysimi Kalt.) commenced from 4th standard week (January last week) with an average 4 aphids/plant. The aphid population increased and gradually reached peak level of 51.15 aphids/plant at 8th standard week (February third week). The highest yield (15.75 q/h) was noticed in cypermethrin 25 EC followed by neem oil 1 per cent (14.50 q/h) marigold leaf 5 per cent (12.90), neem leaf extract 5 per cent (9.25), *Calotropris procera* leaf 5 per cent (8.40 q/h), cow urine 17 per cent (8.20), kinnow leaf 5 per cent (7.08) over 5.80 q/h yield of untreated control. The best cost benefit ratio was obtained with cypermethrin 25EC (1:3.10), neem oil 1 per cent (1:2.64), marigold leaf 5 per cent (1:2.38) neem leaf extract 5 per cent (1:1.44), *Calotropris procera* leaf 5 per cent (1:1.21), cow urine (1:1.19) and kinnow leaf 5 per cent (1:0.87).

Key words : Botanicals, Chemical, Cost benefit ratio, Efficacy, Insecticides, Incidence, , *Lipaphis erysim*i (Kalt.)

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INTRODUCTION

Mustard is a multipurpose crop and India holds a premier position in the global oil seed production accounting 19 per cent of total area and 9 per cent of production. Mustard is a member of family- Brassicacea and has been placed in the genus *Brassica*. Indian mustard plants which bears tiny round edible seed as well as tasty leaves. Mustard is locally called “Sarso” “Rai”, “Raya” and Laha”. The oil obtained from the different types show slight variation in percentage. The oil content varies from 37 to 49 per cent. The seed and oil are used as condiment in the preparation of pickles and for flavouring curries and vegetables. In the tanning industry, mustard oil is used for softening leather. It is also used in preparation of the hair oil, medicine etc. Mustard is rich in minerals like calcium, manganese, copper, iron, selenium, zinc, vitamin A, B, C and proteins. 100g mustard seed contains 508 kcal energy, 28.09g carbohydrates, 26.08g proteins, 36.24g total fat 12.2g dietary fibre (USDA, 2012). Oilseeds come next to food grains in volume and value in the country. Among the oil seed crop, rape seed and mustard play a pivotal role in agricultural economy of the world. The important rapeseed and mustard growing countries of the world are India, Canada, China, Pakistan, Poland, Bangladesh and Sweden. India ranks first in the world in respect of acreage accounting for 31.8 per cent of world (Anonymous, 2010). Mustard aphid (*Lipaphis eryismi* Kalt.) is widely distributed in India and is serious pest of mustard, cabbage, cauliflower, rape seed and other cruciferous crops and vegetables. It multiplies very rapidly, mostly by asexual method. The number of insect pests associated with *Brassica* crop has been reported by Bakhetia and Ghorband (1989).

RESEARCH METHODOLOGY

The present experiment was conducted from November 2013 – April 2014. The main objectives of this experiment was to evaluate the ecofriendly management of mustard aphid (*Lipaphis erysimi*) on mustard (*Brassica juncea* L.)" to study the incidence of mustard aphid during *Rabi* season in 2013-2014 and to study cost benefit ratio. The details of the various materials and methods adopted in the present investigation are listed below.Trial was laid out in a Randomized Block Design consisting of eight different insecticide formulations with one recommended concentration and thus, the total number of treatments was eight. Each treatment was replicated thrice, plot size (2 x 2 = 4 m^2) and Mustard variety Varuna was used for study.

Preparation of insecticidal solution :

The insecticidal spray of desired concentration as per treatment was freshly prepared every time at the time of experimentation just before the start of spraying operations. The spray solution of a desired concentration was prepared by adopting the following formula (Katyayan, 2010) :

$$V = \frac{C \times A}{a.i.\%}$$

where,

V = Volume/ weight of commercial insecticide ml or g.

C = Concentration required.

A = Volume of solution to be prepared.

a.i. (%) = Percentage active ingredient.

Studies on the seasonal incidence of mustard aphid:

Observation was recorded on the incidence and population build up of mustard aphid from germination to harvesting of the crop from Central research field (SHIATS). The population of aphid was observed on ten randomly selected plants from each and number of aphid was recorded on 10 cm long central twig of plant at 15 days' interval (Hugar and Pratiba, 2008).

Benefit cost ratio :

The value of benefit cost ratio of a different treatment was calculated by using following formula :

$$B.C. = \frac{\text{Gross return}}{\text{Total cost in curred}}$$

Reduction pre cent by aphid :

The total numbers of infested and uninfested plants at flowering stage were counted from two rows randomly selected from each plot. Thus, the aphid was calculated using the following formula:

$$\text{Reduction per cent} = \frac{\text{Control} - \text{treatment}}{\text{Control}} \times 100$$

The insect population was recorded two times at pre-spray and post spray stage (3, 7 and 14 days after spray). Five plants from each plot were tagged and the insect population was recorded timely using the following formula (Flemming and Ratnakaran, 1985).

RESEARCH FINDINGS AND ANALYSIS

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Seasonal incidence of mustard aphid *Lipaphis erysimi* Kalt. during *Rabi* season in 2013-2014 :

Studies on the incidence of aphid population with weather parameters is given in Table 1. The occurrence

Table 1 : Details of seasonal incidence of mustard aphid *Lipaphis* erysimi Kalt. and weather parameters during crop period 2013-2014

Sr. No.	Standard week	Date	No. of aphids/plant	Temperature		Humidity %		Rainfall (mm)	Wind velocity	Sunshine (hr/day)
				Max	Min	Morning	Evening			
1.	46	12-18Nov.	0.00	31.51	12.57	91.14	32.28	0.00	1.49	9.28
2.	47	29-25 Nov.	0..00	32.0	13.65	90.85	31.42	0.00	1.59	8.78
3.	48	26-2 Dec.	0.00	30.77	13.4	89.14	32.71	0.00	1.16	9.08
4.	49	3-9 Dec.	0.00	30.42	12.77	91.43	32.42	0.00	1.10	9.2
5.	50	10-16 Dec.	0.00	28.32	12.82	92.42	35.42	0.00	0.98	7.68
6.	51	17-23 Dec.	0.00	23.97	12.2	93.14	40.42	0.00	1.05	4.48
7.	52	24-30 Dec.	0.00	15.4	6.6	93.28	78.42	0.00	1.18	0.37
8.	1	31-6 Jan.	0.00	15.28	6.2	93.71	79.0	0.00	0.65	1.08
9.	2	7-13 Jan.	0.00	19.4	6.11	92.0	48.14	0.00	0.72	6.55
10.	3	14-20 Jan.	0.00	28.2	11.17	88.28	33.57	0.00	2.17	7.37
11.	4	21-27 Jan.	4.00	22.71	7.6	92.85	36.57	0.00	1.73	5.26
12.	5	28-3 Feb.	9.40	24.4	8.0	91.28	33.14	0.00	1.94	6.57
13.	6	4-10 Feb.	15.26	25.88	8.91	90.85	33.0	1.42	2.09	6.08
14.	7	11-17 Feb.	22.64	24.68	9.68	93.14	51.85	6.37	2.00	5.02
15.	8	18-24 Feb.	51.15	25.2	12.77	85.28	39.57	1.25	2.08	6.62
16.	9	25-3 Mar.	39.60	29.82	14.65	82.42	32.14	0.03	1.72	6.79
17.	10	4-10 Mar.	12.25	33.28	15.11	83.85	30.42	0.00	1.73	6.91
18.	11	11-17 Mar.	2.45	33.27	15.02	86.42	35.0	0.03	1.78	6.8
19.	12	18-24 Mar.	0.62	34.31	16.85	84.0	33.0	0.00	2.66	7.83
20.	13	25-31 Mar.	0.00	34.14	18.37	85.14	34.14	1.2	3.09	8.2
			r=	0.014	0.101	-0.438	-0.124	0.370	0.262	-0.001
			t=	0.061	0.431	-2.068	-0.530	1.688	1.153	-0.005
			F-test	S	S	NS	NS	S	S	NS

NS=Non-significant

Table 2: Ecofriendly management of mustard aphid *Lipaphis erysimi* (*kaltenbach*) on mustard *Brassica juncea* (L.) on different days after 1st spray during *Rabi* 2013-2014

Treatments		Before	3 DAS	7 DAS	14 DAS
T_1	Cypermethrin 25EC	39.33	72.88 (58.65)	64.34 (53.37)	55.85 (48.39)
T_2	Marigold leaf 5%	39.33	49.96 (45.00)	47.40 (43.53)	45.68 (42.54)
T_3	Cow urine 17%	39.33	44.78 (42.01)	39.69 (39.04)	37.14 (37.53)
T_4	Neem oil (1%)	40.00	56.64 (48.84)	52.50 (46.45)	50.00 (45.02)
T_5	Neem leaf extract 5%	39.66	52.11 (46.23)	50.40 (45.25)	46.19 (42.83)
T_6	*Calotropis procera* leaf 5%	39.00	48.73 (46.29)	43.58 (41.33)	41.85 (40.32)
T_7	Kinnow leaf 5%	38.33	45.94 (44.29)	41.63 (40.20)	37.24 (37.60)
T_0	Control	40.00	9.14 (00)	21.63 (00)	34.95 (00)
Overal mean		39.37	47.52	45.14	43.61
F- test		----	S	S	S
S.E. (±)		----	1.22	1.19	1.33
C. D. (P = 0.05)		----	2.63	2.55	2.84

of mustard aphid, *Lipaphis erysimi* in 2013-2014 *Rabi* season was commenced from 4th standard week (January last week) with an average 4 aphids/plant. The aphid population increased and gradually reached peak level of 51.15 aphids/plant at 8th standard week (February third week). Thereafter, declined trend was observed. Panda *et al*. (2000) also reported that aphid population incidence starts from last week of January with 4 aphids population/ plant. The larval populations started increasing and reached its maximum of 51.15 mean level population/ plant during third week of February (8th standard week), there after the larval population declined, respectively according to calendar date method.

The occurrence of aphid could be noticed for the first time in 4th standard week at the minimum temperature of 7.6^{0}C, maximum temperature of 22.71^{0}C, relative humidity in the morning 92.85 per cent and evening 36.57 per cent and 0.00 mm rainfall and 5.26 (hr/day) sunshine's, the population at above periods of observation was 4 aphid/plant.

Frist spray :

The data on reduction per cent by *Lipaphis erysimi* Kalt. control on fourteenth day after spraying revealed that all the treatment were significantly superior over control. Among the treatment botanical insecticide, cow urine 17 per cent recorded lowest reduction per cent by aphids (37.14%) followed by kinnow leaf 5 per cent with (37.24%), *Calotropis procera* leaf 5 per cent (41.85%) marigold leaf 5 per cent (45.68%), neem leaf extract 5 per cent (46.19%), neem oil 1 per cent (50.19%) and cypermethrin 25 EC (55.85%) was highest effective among all the treatments during 14th day after 1st spray.

Treatments neem leaf extract 5 per cent and marigold leaf 5 per cent were non-significant and statistically at par with each other. Treatments kinnow leaf 5 per cent and cow urine were also found non-significant and statistically at par with each other.

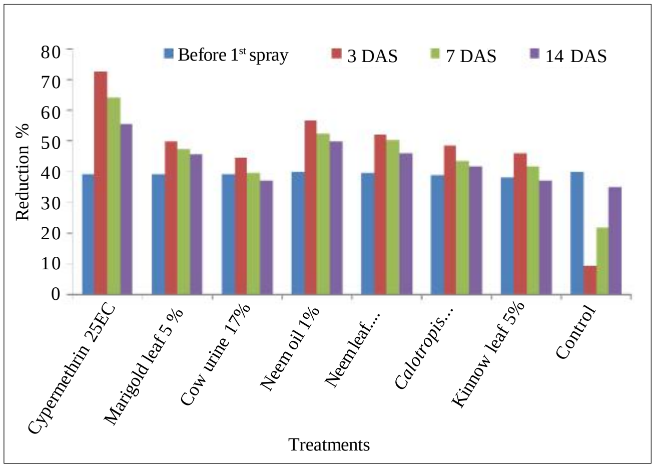

Fig.1: **Efficacy of different treatments on population reduction of mustard aphid day 1st spray during (*Rabi* 2013-2014)**

Second spray :

The data of Table 3 on reduction per cent by *Lipaphis erysimi* (Kalt.) control on fourteenth day after spraying revealed that all the treatment were significantly superior over control. Among the treatments botanical insecticide kinnow leaf 5 per cent recorded lowest

Table 3 : Ecofriendly management of mustard aphid (*Lipaphis erysimi kaltenbach*) on mustard (*Brassica juncea* L.) on different days after 2nd spray during *Rabi* 2013-2014

Treatments		Before	3 DAS	7 DAS	14 DAS
T_1	Cypermethrin 25EC	21.00	80.92 (64.13)	77.74 (61.91)	69.87 (56.72)
T_2	Marigold leaf 5%	26.00	78.13 (62.18)	75.56 (60.43)	(55.56)
T_3	Cow urine 17%	23.00	74.09 (59.45)	72.94 (58.69)	63.46 (52.86)
T_4	Neem oil (1%)	23.66	79.74 (63.30)	76.84 (61.27)	68.01 (55.60)
T_5	Neem leaf extract 5%	23.66	78.86 (62.73)	74.63 (59.84)	46.79 (53.63)
T_6	*Calotropis procera* leaf 5%	26.33	75.92 (60.66)	72.12 (58.17)	46.52 (53,48)
T_7	Kinnow leaf 5%	28.00	74.93 (60.03)	71.36 (57.71)	60.59 (51.16)
T_0	Control	55.33	2.42 (00)	4.23 (00)	3.08 (00)
Overal mean		28.37	68.12	65.67	53.28
F- test		NS	S	S	S
S. E.(±)		---	1.33	1.19	1.54
C. D. (P = 0.05)		---	2.84	2.55	3.31

NS= Non-significant

reduction per cent by aphids with 60.59 per cent followed by cow urine 17 per cent with 63.46 per cent, calotropis procera leaf 5 per cent with 64.52 per cent, neem leaf extract 5 per cent with 64.79 per cent, marigold leaf 5 per cent with 67.95 per cent, neem oil 1 per cent with 68.01 per cent and cypermethrin 25 EC with 69.87 pod infestation was least effective among all the treatments during 14th day after 2nd spray.

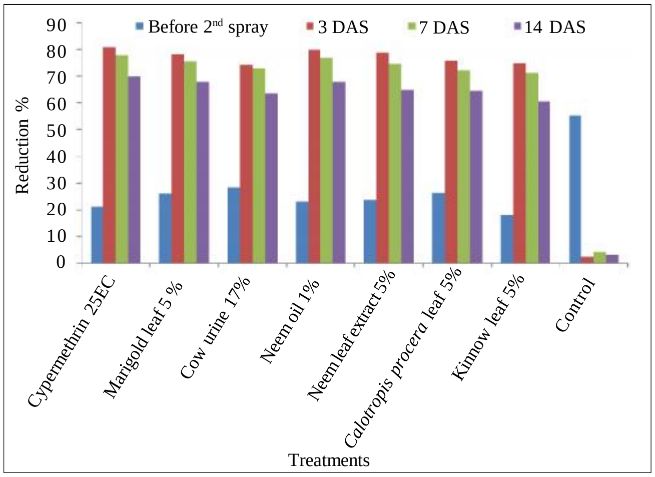

Fig. 2: **Efficacy of different treatments on population reduction of mustard aphid day 2nd spray during (*Rabi* 2013-2014)**

Treatments neem oil 1 per cent and marigold leaf 5 per cent were non-significant and statistically at par with each other. Treatments neem leaf extract 5 per cent, calotropis procera leaf 5 per cent and cow urine 5 per cent were also found non-significant and statistically at par with each other.

Economics of various treatments :

The data of (Table 4) showed that a benefit cost ratio of 1:3.10 was recorded in Cypermethrin 25 EC and proved to be effective among the treatments. However, neem oil 1 per cent recorded second highest benefit cost ratio of 1:2.64 followed by marigold leaf 5 per cent (1:2.38) neem leaf extract 5 per cent (1:1.44), calotropris procera leaf 5 per cent (1:1.21), cow urine 17 per cent (1:1.19) and kinnow leaf 5 per cent (1:0.87) (Singh, 2004), reported that cypermethrin recorded the maximum benefit cost ratio of 1: 3.10 which was followed by neem oil recorded best benefit cost ratio of 1:2.64 followed by other treatments.

Conculsion :

All the treatments were significantly superior over control. Two sprays of cypermethrin 25 EC and and neem oil 1 per cent proved significantly superior over rest of the treatments. These treatment could reduce the reduction per cent by aphid to the extent of (64.79%), (64.52%), (63.46%), (60.59%) after the spray,respectively whereas, *Calotropis procera* leaf 5 per cent (64.52%), cow urine 17 per cent (63.46%), kinnow leaf 5 per cent (60.59%) reduction per cent.

The analysis of cost benefit ratio of all treatments was also carried out which revealed that the highest monetary return was obtained with cypermethrin 25EC (1:3.10) followed by neem oli (1:2.64), marigold leaf (1:2.38), neem leaf extract 5 per cent (1:1.14), calotropis procera leaf 5 per cent (1:1.21), cow urine 17 per cent (1:1.19) and kinnow leaf 5 per cent (1:0.87).

The highest reduction per cent of *L. erysimi* was recorded in the cypermethrin and botanical pesticide neem oil concentration registered first and second, respectively whereas lowest reduction per cent of aphids was found in the kinnow leaf . The pesticide have reduced the hidden toll exacted by the aggregated attack of insect–pests.

Table 4: Economics of treatments taken up for the management of mustard aphid during *Rabi* 2013-2014

Treatments	Yield of q/ha	Value of yield	Total value of yield (Rs.)	Common cost (Rs.)	Treatment cost (Rs.)	Total cost (Rs.)	Net returns	C:B ratio
Cypermethrin 25 EC	15.75	4100 Rs./q	64575	14474	1240	15714	48861	1:3.10
Marigold leaf 5%	12.90	4100 Rs./q	52890	14474	1150	15624	37266	1:2.38
Cow urine 17%	8.20	4100 Rs./q	33620	14474	840	15314	18306	1:1.19
Neem oil 1%	14.50	4100 Rs./q	59450	14474	1850	16324	43126	1:2.64
Neem leaf extract 5%	9.25	4100 Rs./q	37925	14474	1050	15524	22401	1:1.44
Calotropis procera leaf 5%	8.40	4100 Rs./q	34440	14474	1100	15574	18866	1:1.21
Kinnow leaf 5%	7.08	4100 Rs./q	29028	14474	1020	15494	13534	1:0.87
Control	5.80	4100 Rs./q	23780	14474	……...	14474	9306	1:0.64

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